Insights from a sea lamprey into the evolution of neural crest gene regulatory network.

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Public Summary:
In this update, we review the gene regulatory network responsible for neural crest formation in a variety of vertebrate systems. The results reveal that this network is highly conserved across all vertebrates studied to date, suggesting that its origin was at the base of vertebrates.

Scientific Abstract:
The neural crest is a vertebrate innovation that forms at the embryonic neural plate border, transforms from epithelial to mesenchymal, migrates extensively throughout the embryo along well-defined pathways, and differentiates into a plethora of derivatives that include elements of peripheral nervous system, craniofacial skeleton, melanocytes, etc. The complex process of neural crest formation is guided by multiple regulatory modules that define neural crest gene regulatory network (NC GRN), which allows the neural crest to progressively acquire all of its defining characteristics. The molecular study of neural crest formation in lamprey, a basal extant vertebrate, consisting in identification and functional tests of molecular elements at each regulatory level of this network, has helped address the question of the timing of emergence of NC GRN and define its basal state. The results have revealed striking conservation in deployment of upstream factors and regulatory modules, suggesting that proximal portions of the network arose early in vertebrate evolution and have been tightly conserved for more than 500 million years. In contrast, certain differences were observed in deployment of some neural crest specifier and downstream effector genes expected to confer species-specific migratory and differentiation properties.